[0141] In some embodiments, the present invention includes computer storage media having computer instructions or software codes stored therein which can be used to program computers or microprocessors to perform any of the processes of the present invention. The storage media can include, but is not limited to, floppy disks, optical discs, Blu-ray Disc, DVD, CD-ROMs, and magneto-optical disks, ROMs, RAMs, flash memory devices, or any type of media or devices suitable for storing instructions, codes, and/or data.

[0142] The present invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The present embodiment is therefore to be considered in all respects as illustrative and not restrictive. The scope of the invention is indicated by the appended claims rather than by the foregoing description, and all changes that come within the meaning and range of equivalency of the claims are therefore intended to be embraced therein.

What is claimed is:

1. A computer-implemented method for scheduling a crude oil operation process in a refinery, the oil operation process comprising one or more tasks DTSs for oil delivering from one or more storage tanks to one or more charging tanks, the refinery comprising a pipeline system used to transport crude oil from the storage tanks to the charging tanks, the pipeline system comprising a pipeline and a number of pumping stations, and a number of sets of machines in each of the pumping stations, the method comprising:

determining, by a processor, the number of sets of machines n usable at each of the pumping stations, by minimizing energy consumption J for the process based on a linear programming model as follow:

$$\text{Minimize } J = \sum_{i\in G}\sum_{j\in N_{ki}}\sum_{h\in S} C_h x_{ijh};$$

Subject to:

$$\tau_{11} \geq A_{11};$$

$$\sum_{h\in S} x_{1jh} = V_{1j},\ j \in N_{k1};$$

$$\tau_{11} + \sum_{g=1}^{j}\sum_{h\in S} x_{1gh}/f_h + \Omega \leq T_{1j},\ j \in N_{k1};$$

$$\tau_{i1} \geq A_{i1},\ i \in G\backslash\{1\};$$

$$\tau_{i1} \geq \tau_{(i-1)1} + \sum_{j\in N_{k(i-1)}}\sum_{h\in S} x_{(i-1)jh}/f_h,\ i \in G\backslash\{1\};$$

$$\sum_{h\in S} x_{ijh} = V_{ij},\ i \in G\backslash\{1\},\ j \in N_{ki};$$

$$\tau_{i1} + \sum_{g=1}^{j}\sum_{h\in S} x_{igh}/f_h + \Omega \leq T_{ij},\ j \in N_{ki},\ i \in G\backslash\{1\};$$

$$x_{ijh} \geq 0 \text{ and } \tau_{i1} \geq 0;$$

wherein:

n is the number of sets of machines usable at each pumping station;

$S=\{1, 2, \ldots, n\}$ is a set of the number of sets of machines;

d is a number of groups of DTSs;

$G=\{1, 2, \ldots, d\}$;

$N_{ki}=\{1, 2, \ldots, ki\}$;

DTS_{ij} is a j-th DTS in Group $i\in G$ and $j\in N_{ki}$ that is decided by a predetermined schedule;

$G_i=\{DTS_{i1}, DTS_{i2}, \ldots, DTS_{i(ki)}\}$;

V_{ij} is an amount of oil to be transported in DTS_{ij};

TK_{ij} is a charging tank to be charged by performing DTS_{ij} that is decided in the given schedule;

A_{ij} is a time point when TK_{ij} starts to be charged by performing DTS_{ij} as given by the schedule;

B_{ij} is a time point when the charging of TK_{ij} ends as given by the schedule;

T_{ij} is a time point when TK_{ij} charged by performing DTS_{ij} begins to feed a distiller as given by the schedule;

Ω is an oil residency time;

f_i is a most energy-effective oil transportation flow rate when i sets of machines are used at each pumping station;

C_i is a cost coefficient when i sets of machines are used at each pumping station;

x_{ijh} is an amount of oil in DTS_{ij} to be transported by using the most energy-efficient flow rate with h sets of machines being used at each pumping station, $i\in G$, $j\in N_{ki}$, and $h\in S$; and

τ_{i1} is a time point when TK_{i1} starts to be charged by performing DTS_{i1} after oil transportation rate is regulated.

2. The method of claim 1, wherein the C_n is given by n/f_n.

3. The method of claim 1, wherein the energy consumption is minimized by regulating oil transportation rate.

4. A non-transitory computer-readable medium whose contents cause a computing system to perform a computer-implemented method for scheduling a crude oil operation process in a refinery, the oil operation process comprising one or more tasks DTSs for oil delivering from one or more storage tanks to one or more charging tanks, the refinery comprising a pipeline system used to transport crude oil from the storage tanks to the charging tanks, the pipeline system comprising a pipeline and a number of pumping stations, and a number of sets of machines in each of the pumping stations, the method comprising:

determining, by a processor, the number of sets of machines n usable at each of the pumping stations, by minimizing energy consumption J for the process based on a linear programming model as follow:

$$\text{Minimize } J = \sum_{i\in G}\sum_{j\in N_{ki}}\sum_{h\in S} C_h x_{ijh};$$

Subject to:

$$\tau_{11} \geq A_{11};$$

$$\sum_{h\in S} x_{1jh} = V_{1j},\ j \in N_{k1};$$

$$\tau_{11} + \sum_{g=1}^{j}\sum_{h\in S} x_{1gh}/f_h + \Omega \leq T_{1j},\ j \in N_{k1};$$

$$\tau_{i1} \geq A_{i1},\ i \in G\backslash\{1\};$$